REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	May 1990	Final 15 Mar 1987 - 24 Mar 1990

4. TITLE AND SUBTITLE
Development of Microencapsulation Techniques

5. FUNDING NUMBERS
DAAL03-87-K-0044

6. AUTHOR(S)
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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U. S. Army Research Office
P. O. Box 12211
Research Triangle Park, NC 27709-2211

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
ARO 23967.5-CH

11. SUPPLEMENTARY NOTES
The view, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

Surfactant vesicles are small, spherical shell-like structures composed of bilayers of surfactant molecules which can be used to contain an aqueous solution. Since a variety of materials can be encapsulated in such vesicles, they are ideal vehicles for many different applications. The advantages of vesicle formulations involve protection from the environment, sustained release, and targeted delivery of vesicle contents. Such potential for phospholipid vesicles as chemical delivery systems, and possibly many other roles has motivated a significant effort towards

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(JG)

14. SUBJECT TERMS
Microencapsulation Techniques, Membrane Stability, Vesicle Fusion, Permeability, Lipid Analogues, Disulfide Polymerization, Cholesterol Derivatives, Chemical Engineering Applications

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRAC
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

NSN 7540-01-280-5500
Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102

improving their properties. The primary objectives for much of the current research in this area have therefore been to obtain enhanced membrane stability (mechanical and chemical) and decreased or controlled vesicle fusion and permeability. Major progress toward these ends has been made by the introduction of polymerizeable lipid analogues and to a lesser extent with the formation of polymer coated vesicles.

Studies have been made of the effects of disulfide polymerization and the incorporation of cholesterol derivatives on the structure and properties (permeability, stability, and size) of phospholipid vesicles. Studies have been initiated on the interaction of polymers with liposomes.

ARO 23967.5-CH

DEVELOPMENT OF MICROENCAPSULATION TECHNIQUES

FINAL TECHNICAL REPORT

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14 May 1990

U. S. ARMY RESEARCH OFFICE

For

Contract DAAL03-87-K-0044

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Final Report May 3, 1990

DEVELOPMENT OF MICROENCAPSULATION TECHNIQUES

Surfactant vesicles are small, spherical shell-like structures composed of bilayers of surfactant molecules which can be used to contain an aqueous solution. Since a variety of materials can be encapsulated in such vesicles, they are ideal vehicles for many different applications. The advantages of vesicle formulations involve protection from the environment, sustained release, and targeted delivery of vesicle contents. Such potential for phospholipid vesicles as chemical delivery systems, and possibly many other roles has motivated a significant effort towards improving their properties. The primary objectives for much of the current research in this area have therefore been to obtain enhanced membrane stability (mechanical and chemical) and decreased or controlled vesicle fusion and permeability. Major progress toward these ends has been made by the introduction of polymerizeable lipid analogues(1) and to a lesser extent with the formation of polymer coated vesicles(2).

With support of the Army Research Office (Grant No. DAAL03-87-K-0044) we have explored the effects of disulfide polymerization and incorporation of cholesterol derivatives on the structure and properties (permeability, stability, and size) of phospholipid vesicles. We have also initiated studies of the interaction of polymers with liposomes.

The detailed results of these studies have been published or submitted for publication as follows:

1. Handel, Tracy M., "Disulfide Polymerizeable Phosphatidylcholines: Characterization of Membrane Physical Properties and Investigations of *in vivo* Behavior". Ph.D. diss., California Institute of Technology, Pasadena, CA, 1989.
2. Goodrich, Raymond P., "Membrane Bound Carbohydrates: An Approach for Stabilization During Freezing and Drying". Ph.D. Diss., California Institute of Technology, Pasadena, CA. 1990.
3. Goodrich, Raymond P., Handel, Tracy M. BBA 938, 143-154, 1988.
4. Goodrich, Raymond P., Crowe, John H., Crowe, Lois M., Baldeschwieler, John D. Biochem. 1990, submitted. "Alterations in Membrane Surfaces Induced by Attachment of Carbohydrates".

5. Goodrich, Raymond P., John D. Baldeschwieler, BBA 1990, submitted. "Protection of Vesicles Against Damage During Freeze Drying by Addition of Membrane Associated Carbohydrate Derivatives".
6. Goodrich, Raymond P., Baldeschwieler, John D., Cryobiology 1990, submitted. "The Cryoprotective Action of Synthetic Glycolipids".

I have attached copies of the abstracts of the two theses (nos. 1. and 2.) as well as preprints of the three manuscripts which have recently been submitted for publication.

List of scientific personnel:

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Raymond P. Goodrich, Ph.D., 1990
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